Alternative Erosion Prevention and Sediment Control BMPs

To encourage the development and testing of innovative alternative EPSC BMPs, alternative management practices that are not included in the Handbook, Standard Specifications and Standard Drawings may be accepted upon review and approval. To use an alternative BMP, submit substantial evidence that the proposed measure will perform at least equivalent to currently approved BMPs contained in the Handbook, Standard Specifications, and Standard Drawings. Evidence may include, but is not limited to:

- Supporting hydraulic and trapping efficiency calculations.
- Peer-review by a panel of licensed professional engineers.
- Research results as reported in professional journals.
- Manufacturer literature.

To justify the efficiency of innovated EPSC BMPs, the owner may be required to monitor the trapping efficiency of the structure. If satisfactory results showing trapping efficiencies of greater than 80 percent are obtained, the innovative BMP may be used and no other monitoring studies should be required. If monitoring shows that a certain BMP is not sufficient or if SCDHEC finds that a BMP fails or is inadequate to contain sediment, other upstream and downstream BMPs should be implemented to reach the required efficiency.

Post Construction Water Quality Control

Post-construction storm water management in areas undergoing new development or redevelopment is necessary because runoff from these areas significantly affects receiving waterbodies. There are two forms of substantial impacts of post-construction runoff. The first is an increase in the type and quantity of pollutants in storm water runoff. As runoff flows over areas altered by development, it picks up harmful sediment and chemicals such as oil and grease, pesticides, heavy metals, and nutrients. These pollutants become suspended in runoff and are carried to receiving waters, such as lakes, ponds, and streams. Once deposited, these pollutants enter the food chain through small aquatic life, eventually entering the tissues of fish and humans.

The second kind of post construction runoff impact is increasing the quantity of water delivered to the waterbody during storms. Increased impervious surfaces interrupt the natural cycle of gradual percolation of water through vegetation and soil. Instead, water is collected from surfaces such as asphalt and concrete and routed to drainage systems where large volumes of runoff quickly flow to the nearest receiving water. The affects of this process include streambank scouring and downstream flooding, which often lead to a loss of aquatic life and damage to property.

Water Quality Regulations

Water quality control consists of post-development controls that reduce the impacts of development on the water quality of receiving downstream water bodies. Use the following design criteria for water quantity control unless a waiver is granted on a case-by-case basis.

- Design permanent water quality ponds and detention structures having a permanent pool elevation to store and release the first ½-inch of runoff from the site over a minimum period of 24-hours. Design the water quality storage volume of these water quality structures to accommodate at least one-half (½) inch of runoff from the contributing drainage area.

- Design permanent water quality structures **not** having a permanent pool elevation to store and release the first one 1-inch of runoff from the site over a minimum period of 24-hours.

- Design permanent water quality ponds and detention structures within ½-mile of a receiving water body in the coastal zone to store a volume of ½-inch of runoff from the entire site or the first 1 inch of runoff from built-upon portions of the property, which ever is greater.

- Design projects located within 1,000 feet of shellfish beds to retain the first 1.5 inches of runoff from built-upon portions of the property.

- Design permanent water quality infiltration practices to accommodate at a minimum the first 1-inch of runoff from impervious areas located on the site.

- When existing wetlands are intended to be water quality structures, the Storm Water Management Permit is not implemented until all necessary Federal and State permits have been obtained.

Water Quality Volume

The water quality volume is the storage needed within a water quality control BMP to control the "first flush" of runoff during a storm event. The water quality volume can be calculated as:

$$WQV = \frac{FFV * DA}{12}$$

Where:
FFV = First flush runoff depth inches (½, 1.0, or 1-½ dependent upon site conditions)
WQV = Water quality volume (acre-feet)
DA = Design drainage area to water quality BMP (acres)

Variances

SCDHEC may grant variances from the State Storm water Management Regulations for post-construction water quality if the applicant provides sufficient data and acceptable justification. The applicant must provide a written request for a variance in the Permit application package specifically stating the variances sought and all data that supports the variance. SCDHEC has the authority to reject a written request for a variance if the justification is deemed unacceptable or is associated with a project located in sensitive areas of South Carolina where variances have been deemed to be unacceptable.

A project may be eligible for a waiver from water quality control requirements if the applicant can justly verify that:

- The proposed land development activity will return the disturbed areas to the pre-development land use and runoff conditions.
- The proposed land development will create land use conditions that have the potential to discharge less pollutants than the pre-development land use conditions.
- The pre-development land use conditions are unchanged at the end of the project.
- An alternative water quality plan is designed that provides a reasonable alternative to water quality storage and release time requirements and that still fulfills the intent of the regulations. Specific development sites may not have enough land area to incorporate traditional water quality structures that provide the required storage volume. Alternative technologies and development techniques may be acceptable provided that sufficient documentation exists as to the effectiveness and reliability of the proposed structures or techniques.
- Exceptional circumstances exist such that strict adherence to the regulations could result in unnecessary hardship and not fulfill the intent of the regulations.

This variance does not exclude water quality, erosion prevention, sediment control from being implemented during the active construction phases of a particular project.

Water Quality BMPs

Water Quality control BMPs can be classified into two major classifications:

- Non-structural Controls
- Structural Controls.

The following post construction water quality BMPs are discussed in this BMP Manual:

Non-Structural Low Impact Development Controls

Vegetated Conveyance Systems
Stream Buffers
Disconnected Rooftop Drainage to Pervious Areas
Cluster Development
Natural Infiltration

Structural Controls

Wet Detention Ponds
Dry Detention Ponds
Underground Detention Systems
Storm Water Wetlands
Bioretention Areas
Infiltration Trench
Enhanced Grassed Swales
Pre-Fabricated Control Devices
Vegetated Filter Strips (VFS)
Grass Paving and Porous Paving Surfaces

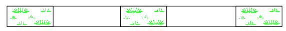
Innovative Technologies

To encourage the development and testing of innovative alternative water quality BMPs, alternative management practices that are not included in the Handbook, Standard Specifications and Standard Drawings may be accepted upon review and approval.

Non-Structural Low Impact Development Controls

Vegetated Conveyance Systems

Plan Symbol



Description

Vegetated conveyances are designed and installed as an alternative to curb and gutter and hard piping storm water conveyance systems. Open vegetated conveyances improve water quality by providing partial pollutant removal as water is filtered by the vegetation and by the opportunity to infiltrate into the soil. Open vegetated conveyances also are designed to reduce flow velocities when compared to hard piping systems.

When and Where to Use It

Open vegetated conveyance systems are incorporated into moderate to low density development sites where land is available and where the land surface is gently sloping (less than 5 percent). The soil must be able to withstand the design tractive forces and flow velocities of the open conveyance, or an applicable

Design Criteria

Design Turf Reinforcement Mats or Erosion Control Blankets to protect the open conveyance. Install a dense cover of strong rooted vegetation in the conveyance systems. For maximum water quality benefits, design vegetated open conveyances with a flat longitudinal slope to promote low velocity flow.

Installation

Construct vegetated conveyances with trapezoidal or parabolic cross section with relatively flat side slopes (flatter than 3H:1V).

Install a flat bottom between 2 and 8 feet wide.

During construction, it is important to stabilize the channel before the turf has been established, either with a temporary grass cover or with the use of natural or synthetic erosion control products.

Inspection and Maintenance

- The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely.
- The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.
- Maintenance includes periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, re-seeding of bare areas, and clearing of debris and blockages.
- Remove accumulated sediment manually to avoid the transport of resuspended sediments in periods of low flow and to prevent a damming effect from sand bars. Minimize the application of fertilizers and pesticides.
- Repair damaged areas within a channel.
- Inspect for a healthy thick grass cover. Re-seed as necessary.

Stream Buffers

Description

A stream buffer is an area along a shoreline, wetland or stream where development is restricted or prohibited. The primary function of the buffer is to physically protect and separate a stream, lake, or wetland from future disturbance or encroachment.

The general function of the buffer is to:

- Protect the overall stream quality by providing shade for the stream and provide wildlife habitat.
- Remove pollutants, sediments, bacteria, and excess nutrients from storm water runoff through infiltration and filtering.
- Help detain and slow down flow rates from developed areas.
- Provide a setback from the stream to prevent damage to structures or improved property due to flooding or changes in the stream channel.

When and Where to Use It

Effective water quality protection stream buffers consist of undisturbed natural vegetation including maintaining the original tree line along the stream or channel banks. Promptly stabilize disturbed buffers with a dense cover of strong rooted grasses, native plants, and native trees.

Buffer Classification

Major streams, drainageways and waterbodies are recommended to have buffer protection. Buffer recommendations are based on the following classifications:

Class 1: Streams thhave a drainage area greater than or equal to 100 acres.
Class 2: Streams that have a drainage area greater than or equal to 300 acres.
Class 3: Streams that have a drainage area greater than or equal to 640 acres.

Stream Buffer Recommendations

Stream Class	Stream Side Zone (ft)	Managed Use Zone (ft)	Upland Zone (ft)	Total Buffer Width on Each Side of the Stream (ft)
1	30	None	15	45
2	30	20	15	65
3	30	45	25	100

**All buffer widths are measured from the top of the streambank.

Stream Side Zone

This zone is the closest to the stream and this area and remains undisturbed. The stabilization and protection of this zone is critical to water quality. Clearing and cutting of vegetation is prohibited in this zone with the desirable vegetation being mature forest. Use of this zone includes flood control structures, streambank stabilization and restoration, footpaths, and utility or road crossings.

Managed Use Zone

This area provides space for the storage of floodwaters and the filtering of pollutants. A limited number of trees may be removed from this zone provided that the remaining tree density is a minimum of eight healthy trees of a minimum 6-inch caliper per 1,000 square feet. The vegetative target for this zone is managed forest but turfgrass can also be a vegetative target. Do not place fill materials in this area, and do not conduct grading and other land disturbing activities. Some storm water BMPs, greenway trails and bike paths may be designed in this area.

Upland Zone

This zone is located furthest from the streambank. Grading is permitted in this zone, in a manner that does not damage the roots of the trees located in the adjacent Managed Use Zone. Grass or other suitable ground covers may be planted in this zone. Do not place fill material in the Upland Zone unless the replacement of deficient soil is required. The volume of fill material shall not exceed the volume of deficient soil removed. Personal gardens, gazebos, decks, and storage building less than 150 square feet in size are permitted in the Uplands Zone.

Buffer Design Requirements

For optimal storm water treatment, the following buffer designs are recommended:

- The buffer consists of three lateral zones; Stream Side, Managed Use and Upland Zones.
- The buffer has a storm water depression area that leads to a grass filter strip before entering the Managed Use Zone. Design the storm water depression to capture the first flush runoff from the site and bypass larger storm flows directly to the receiving water body.
- Spread the captured runoff across a grass or wooded filter in a sheet flow condition. The forest buffer of the Stream Side and Managed Use Zones infiltrates the sheet flow and does not discharge any surface runoff to the receiving water body.

Buffer Maintenance

An effective buffer management plan includes establishment, management, and distinctions of allowable and unallowable uses in each Zone. Buffer boundaries are well defined and clearly marked during, and after construction is complete. Buffers designed to capture storm water runoff from urban areas require more maintenance if the first zone is designated as a bioretention or other engineered depression area.

Disconnected Rooftop Drainage to Pervious Areas

Description

Disconnected rooftop drainage reduces the runoff flow rates from developed areas. The disconnection involves directing storm water runoff from rooftops towards pervious areas where it is allowed to filter through vegetation and other landscaped material and infiltrate into the soil. Use erosion control devices such as splash blocks or level spreaders at the downspout discharge point to transfer the flow from concentrated flow to sheet flow.

Disconnected rooftop drainage has the following benefits:

- Increase the time of concentration by disconnecting runoff from any structural storm water drainage systems.
- Provide water quality benefits by allowing runoff to infiltrate into the soil. Downspouts from rooftops should discharge to gently sloping, well-vegetated areas, vegetated filter strips, or bio-retention areas.

When and Where to Use It

This practice is applicable and most beneficial in low-density residential or commercial developments having less than 50 percent impervious area. Disconnection is not applicable to large buildings where the volume of runoff from the rooftops will cause erosion or degradation to receiving vegetated areas.

Cluster Development

Description

Cluster development practices concentrate development away from environmentally sensitive areas such as streams, wetlands, and mature wooded areas. The clustering of development in one area reduces the amount of roadways, sidewalks, and drives required when compared to development sprawled over the entire land area.

Install clustering and conservation of natural area practices at least to some extent on all development sites not only to reduce the impacts to natural resources by minimizing disturbance and impervious areas, but also to maintain some of the natural beauty of the site.

Reducing the amount of disturbed area and impervious area reduces the amount of runoff volume treated for water quantity and water quality control. Concentrating development away from environmentally sensitive areas will also reduce the amount of time and expenses to get federal and state permits for impacting jurisdictional waters.

Concentrate development on the flattest part of the development parcel away from environmentally sensitive areas such as steep slopes, streams, and wetlands. This reduces the impacts to these areas, and reduces the amount of earth moving necessary for the development.

Natural Infiltration

Description

Natural infiltration is a method in which an undisturbed land area covered with natural vegetation accepts runoff from new development and infiltrates the runoff into the soil.

When and Where to Use It

Use natural infiltration areas only where the soils are suitable. The area is typically in a forested condition with the land surface covered by leaves, pine needles, and other forest floor organic materials. Natural infiltration areas are designated for passive recreation only.

Design Criteria

Use a natural infiltration area as a storm water quality control if it meets the design criteria of this section. The size of a natural infiltration area is calculated using the following equation:

$$A = \frac{(K\ T\ I)}{[(cd) - K]}$$

Where:

A	=	Natural infiltration area required (acres)
K	=	Runoff volume to infiltrate (inches)
T	=	Total site area or total drainage area (acres)
I	=	Built upon area ratio (Built upon area / T)
c	=	Effective water capacity (in/in), should be determined from site-specific soil samples.
d	=	Depth of soil A horizon (inches), should be determined from site-specific soil samples.

Runoff enters the infiltration area as sheet flow with a non-erosive velocity. Stabilize and vegetate the areas draining to the Natural Infiltration area a minimum of 20-feet in length.

Natural infiltration areas have the following characteristics:

- Appropriate soils that have a minimum infiltration rate of 0.3-inches per hour, low erosion potential, and good drainage (not in a wetland or floodplain).
- Mature forest cover (if the natural infiltration area (A) is not located in a mature forest, then double the area of that calculated by the equation above).
- Slopes less than 10 percent.
- Remains permanently undisturbed.

The limitations of natural infiltration areas include:

- Not suitable for soils that have greater than 30 percent clay content or greater than 40 percent clay and silt content.
- Not suitable in areas with high water tables or shallow depth to highly impervious strata such as bedrock or clay layers.
- High sediment loadings or lack of maintenance clogs the surface layer therefore inhibiting any water infiltration into the soil.